CLAIMS

We claim:

1) The method of detecting gene expression pattern comprises selecting a number of genes from gene expression profiles.

2) The method defined in claim 1 and further extracting gene expression signature embedded in gene expression profiles.

3) The method defined in claim 1 and extracting the gene expression signature from the gene expression profile comprises several hundreds to tens of thousands genes which are measured by means of cDNA microarray, high density oligonucleotide array, random optic fiber array, and other platforms

4) The method of extracting gene expression signature, according to claim 2, wherein the gene expression signature from the gene expression profile is associated with biological functions or biological status.

5) The method defined in claim 1 including the step of performing frequency domain transforms using transforming functions comprising wavelets.

6) An apparatus wherein gene expression profile is processed to provide a plurality of gene expression pattern to permit maximal separation among gene expression pattern, said gene expression signature representing different biological functions.

7) The apparatus defined in claim 6 comprising devices for extracting gene expression signature from frequency domain to permit clustering of gene associated with permutations of biological function and status; and to provide reproducible classification for permutations, biological status and functional association of genes.

8) Apparatus defined in claim 6 including apparatus for processing gene expression profiles comprising a gene order library coupled to a gene order selection device;
a gene expression profile input device;
an ordered gene profile processor ;
said gene order selection device and said gene expression profile input device both coupled to said gene expression profile processor;
an output device;
said ordered gene profile processor being coupled to said output device;
and a wavelet library and wavelet selection device being coupled through a frequency domain converter to said ordered profile processor.

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9) The apparatus defined in claim 8 including an output device and an error examiner coupled to said output device, said error examiner being coupled through a storage device to said ordered profile processor.

10) A method of extracting gene expression signature based on a frequency domain transformation using wavelets comprises: forming an input gene expression profile as training and testing profiles;
converting the gene expression profile into relative gene expression profile;
selecting a gene order;
converting the relative gene expression profile into an ordered relative gene expression profile;
selecting a wavelet function;
selecting a scale;
transforming the ordered relative gene expression profile with the selected wavelet and scale;
training a classifier by classification method, comprising MPL or Bayesian neural network, with the wavelet transformed gene expression profile;
forming an ordered relative gene expression profile with a set of validating data with the same scale and wavelet used to form the training and testing profiles;
calculating an estimated error with the trained classifier.

11) The method defined in claim 10 and further determining optimal orders of genes to permit formation of reproducible clusters and classification of genes and permutations of biological states represented by gene expression profiles.

12) The method according to the claim 10 wherein an iterative procedure is utilized with different gene orders, wavelet functions and scales to determine the order of genes, the wavelet function and scale for the obtained classifier that demonstrates the lowest estimate error for classification of validating data set.

13) The method defined in claim 12 and converting the ordered relative gene expression profile into frequency domain at different scale after rearranging the order of genes.

14) The method according to claim 12 wherein a scale is selected for frequency domain transform of the gene expression profiles to permit maximal separation among gene expression signature representing different functions.

15) The method defined in claim 12 wherein said wavelet function is selected from the selecting device including a keyboard and a computer program subroutine function.